

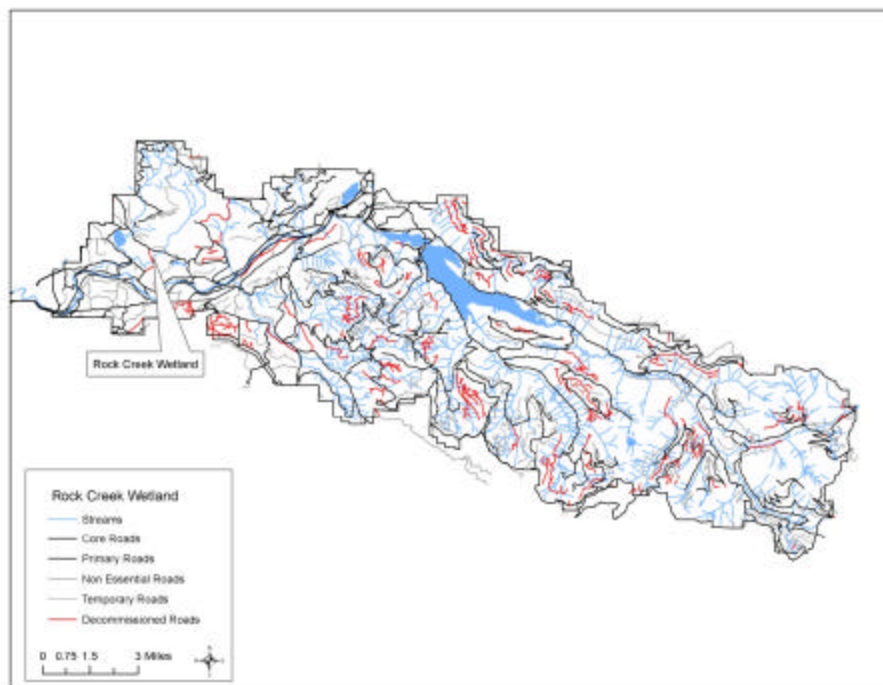
# Rock Creek Wetland Habitat Restoration Project

## As-Built Document

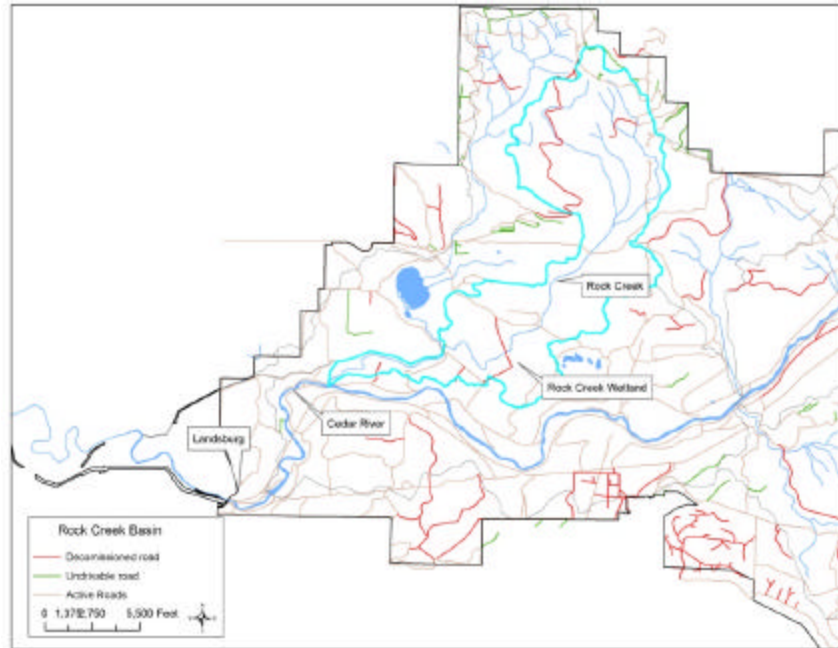
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### Background

Rock Creek Wetland (RCW) is located in the western portion of the Cedar River Municipal Watershed (figure 1). It is the largest low-elevation (720-760 ft above sea level, asl) wetland complex in the watershed, encompassing approximately 100 acres of open water, shrub and herb-dominated wetland, wet forest, and bog. The headwaters of Rock Creek are on Brew Hill at an elevation of approximately 2,450 ft asl. Once the creek enters the area of low topographic relief and the wetland complex, it is no longer restricted to a single channel. Rock Creek drains an area of over 3,100 acres (figure 2) and empties into the Cedar River 2.1 miles upstream of the Landsburg Diversion Dam. The diversion dam was built in 1901 and blocked fish passage for over 100 years. In 2003 a fish ladder allowed access to over 12.5 miles of habitat in the Cedar River above the dam, plus habitat in Rock Creek and RCW. Since then Coho salmon have been documented spawning in Rock Creek and may be using portions of RCW as rearing habitat.



**Figure 1.** Location of Rock Creek Wetland within the municipal watershed



**Figure 2.** Rock Creek drainage area (highlighted in blue)

Rock Creek Wetland is an important amphibian breeding area for red-legged frog (*Rana aurora*), northwestern salamander (*Ambystoma gracile*), Pacific tree frogs (*Pseudacris regilla*), long-toed salamanders (*Ambystoma macrodactylum*) and roughskinned newt (*Taricha granulose*). Beaver (*Castor canadensis*) are very active within the wetland complex, creating numerous dams that frequently change the water levels in portions of the site. They directly and indirectly create abundant snags and downed wood. This diverse habitat supports numerous bird and mammal species, many of which are listed in the Cedar River Watershed Habitat Conservation Plan.

Although a complete plant inventory has not been completed, RCW is currently botanically diverse, supporting a variety of native plant species ranging from coniferous and deciduous trees, to shrubs, forbs, herbs, grasses, sedges, and aquatic plants. The wetland also has large infestations of non-native invasive plant species, including dense patches of Bohemian knotweed (*Polygonum x bohemica*, a hybrid between Japanese (*P. cuspidate*) and giant knotweed (*P. sachalinense*), large thickets of both Himalayan (*Rubus armeniacus*) and Evergreen (*Rubus laciniatus*) blackberry, large dense mats of bittersweet nightshade (*Solanum dulcamara*), and patches of reed canary grass (*Phalaris arundinacea*). English holly (*Ilex aquifolium*) is scattered throughout the forest and there are a few isolated butterfly bush (*Buddleja davidii*) and tansy ragwort (*Senecio jacobaea*) plants.

The forest surrounding RCW was harvested for timber in the early 1900s, and there were homesteads in the vicinity, which are likely the source of many of the non-native plant species. The 16 Road was built through the center of the wetland in order to extract timber and was maintained through the early 1990s.

Because of the importance of RCW for such a large number of fish and wildlife species, it was a high priority for restoration work.

## **Project Objectives**

The project objectives were to functionally reconnect the wetland, restore the natural hydrology, and restore native plant systems and ecosystem functioning. Specific objectives included eradicating knotweed, butterfly bush, and tansy ragwort, and eliminating the large thickets blackberry and matting areas of nightshade, thereby greatly reducing the ecological influence of these species.

## **Treatments**

Treatments included:

- Road decommissioning to reconnect the wetland and help restore the natural hydrology
- Invasive plant species control and eradication by various methods, and planting native plant species to restore native plant systems and ecosystem functions

## **Road Decommissioning**

The 16 Road was decommissioned by Seattle Public Utilities staff in 2002. Road fill was removed from strategic locations and major portions of the wetland were reconnected. Several areas of the old roadbed where fill was removed now have water at or near the surface for much of the year, and native vegetation has completely recolonized these sites. Fill was removed from the two major channels of Rock Creek and the channels were restored to natural streambeds. Wood was strategically placed near the channel closest to the 10 Road, to help avoid the creek flowing along the old 16 Roadbed and threatening the integrity of the 10 Road. In subsequent years, flow in Rock Creek has moved between the two major channels; at times all the flow has been in one channel and at other times the flow has split between the channels, with varying amounts in each channel. Rock Creek flow downstream of the 16 Road becomes much more dispersed and affected by the numerous beaver dams. The old roadbed was planted with over 1,675 native trees and shrubs shortly after the decommissioning was completed, to diversify the native plant community. There was vigorous plant growth over the next ten years and by 2011 in many areas it was becoming difficult to tell where the old roadbed had been.

## **Invasive Plant Species Control and Eradication**

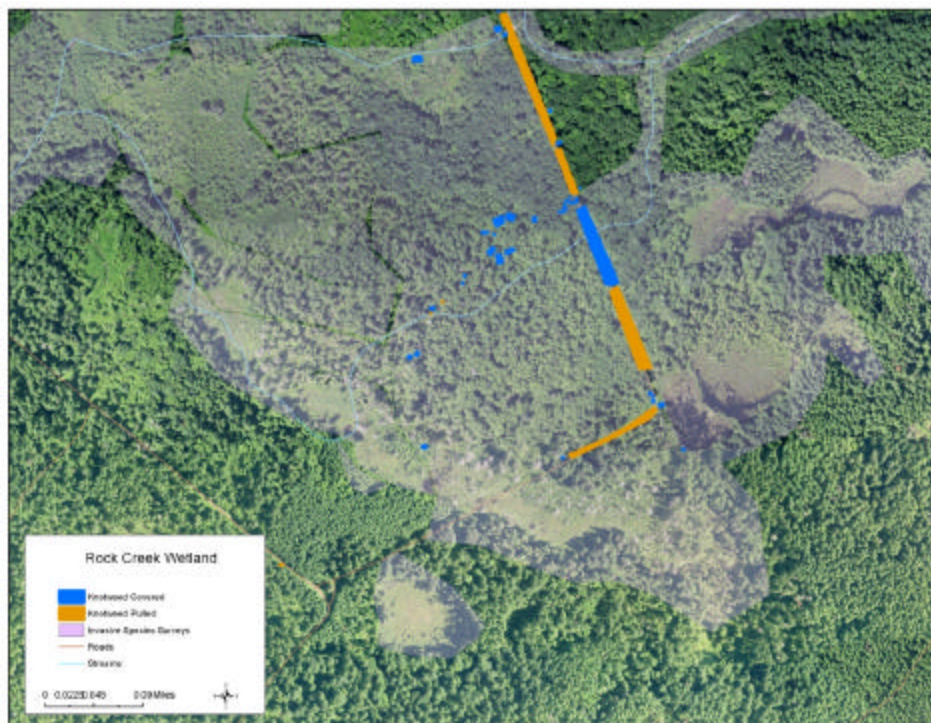
### Knotweed

Knotweed poses one of the greatest threats of any invasive plant species within the watershed. At the time of decommissioning, there was an extremely dense knotweed infestation (~15,000 ft<sup>2</sup>) that extended for over 500 feet along the road, starting at about 1,900 feet south of the 10 Road. During the decommissioning, the knotweed roots were dug out with heavy equipment, hauled off site, and buried. This process was unsuccessful in controlling the knotweed and resulted in spreading the infestation along a much larger portion of the roadbed (over 30,000 ft<sup>2</sup>) as early as 2003. Knotweed was pulled during two volunteer events in 2003, but this limited effort was also ineffective in controlling the infestation.

At that time, herbicide use (the preferred and often only effective treatment for knotweed) within the municipal watershed was completely prohibited, leaving only mechanical treatment options. Since pulling large established infestations is ineffective, in 2004 we attempted to starve the

knotweed roots by covering over 25,000 ft<sup>2</sup> of the dense infestation along the old roadbed. We initially used three different types of fabric – heavy black plastic, woven plastic geotextile fabric, and non-woven felt geotextile fabric. We found that the black plastic tore easily, so over the next several years we replaced torn sections with the more durable geotextile fabric. The fabric was placed over the most heavily infested areas, which were those areas adjacent to the forest edge. The center of the roadbed generally had isolated individual knotweed plants, and was left uncovered to function as a wildlife travel corridor. The fabric was placed loosely over the dense patches and anchored at the edges with rocks or logs. This allowed some plant growth underneath without tearing through the fabric. Growth under the fabric generally only occurred during the first growing season after the fabric was placed.

Portions of the wetland away from the 16 Road were surveyed each year, culminating in a 2007 systematic search for knotweed with numerous staff and expert volunteers walking parallel transects through the wetland. Several large knotweed infestations away from the 16 Road were discovered and an additional 5,000 ft<sup>2</sup> of fabric was installed on these patches. Native conifer trees were planted around the fabric edges to help provide shade to suppress knotweed over the long-term. No further knotweed patches have been found, and the wetland has now been completely surveyed for invasive species (figure 3).



**Figure 3.** Area surveyed for invasive species and knotweed found within the Rock Creek Wetland. The decommissioned 16 Road is the linear feature along which knotweed is either pulled or covered.

All knotweed patches were monitored, fabric maintained, and isolated knotweed plants pulled multiple times per year from 2004 – 2011. This took from five to nine staff person days per year, plus varying amounts of contractor days, depending on how much black plastic needed to be replaced and new fabric installed each year (see Appendix I for a complete description of work completed by year, including number of staff, contractor, and volunteer days and contractor



costs). Within a few years the uncovered areas in the center of the roadbed became thickly vegetated with native species (both planted and naturally regenerated) and the frequent pulling slowly diminished the number of isolated knotweed plants.

In 2008, a small amount of fabric (400 ft<sup>2</sup>) was removed from small knotweed patches in areas that were inundated for much of the year. No subsequent knotweed growth was seen in these patches, so in 2009 an additional 4,400 ft<sup>2</sup> of fabric was removed from smaller patches (after five years of covering). This also yielded no further growth, and in 2010 and 2011 the remaining fabric along the roadbed was removed. In some of the larger areas with the initially densest infestations, there was considerable re-growth of small knotweed plants even after six or seven years of continual covering, casting doubt on the efficacy of the fabric method.

In 2010 Seattle City Council passed Council Bill #116902, an ordinance that through 2012 allowed limited application of the herbicide Imazapyr to treat knotweed within the municipal watershed. Because the fabric treatment was unsuccessful in controlling the larger patches along the decommissioned 16 Road, in 2011 we did very limited spot applications to the knotweed regrowth as part of the larger knotweed treatment. We also planted additional conifer trees within the knotweed patches to help provide shade, which should make the growing conditions less favorable to knotweed over the long term.

#### Other Invasive Plant Species

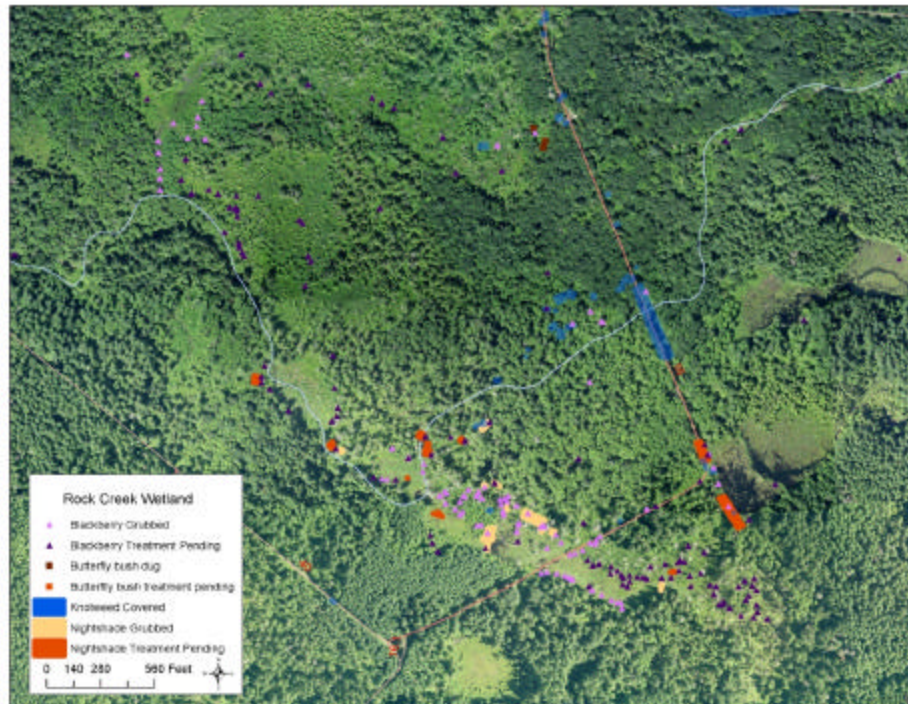
As part of the invasive species surveys, all Himalayan and evergreen blackberry thickets and individual large plants, nightshade mats, and individual plants of butterfly bush and English holly were mapped using GPS technology. Blackberry thickets and individual plants along the 16 Road and within the wetland were grubbed out from 2005 – 2011. Because blackberry can re-growth from root fragments and seeds are viable for many years, each blackberry site needs to be treated for multiple years. By 2011, all large thickets had been reduced to scattered individual plants. Areas with closely spaced individual plants in the southeast and northwest portions of the wetland (figure 4) will soon become thickets and still need to be treated. It is much more cost-effective to treat blackberry when they are still individual plants.

The largest mats of nightshade were grubbed out and removed from the wetland in 2009 and 2010. Numerous smaller mats have not yet been treated.

A total of three butterfly bush plants were found and grubbed out in 2008 and 2010. Only a few individual tansy ragwort plants are occasionally found along the decommissioned 16 Road. All are pulled as soon as they are found. English holly has not yet been treated. Reed canary grass is planned to be mapped starting in 2012, but no treatment is currently planned.

As part of the early detection/rapid response protocol of the Watersheds Invasive Species Program (see monitoring section below), greater burdock (*Arctium lappa*) and foxglove (*Digitalis purpurea*) are pulled whenever they are found, in order to prevent these non-native species from spreading into the wetland. Burdock was becoming quite common along the 16 Roadbed in 2004, but after treatment is only occasionally seen. Foxglove was found in high concentration in a single site near a channel of Rock Creek in 2011, and most plants were pulled

prior to seeding. This treatment has been successful in other areas, so is expected to stop its invasion into the wetland as well.



**Figure 4.** Treatment of invasive plant species in Rock Creek Wetland through 2011.

## Monitoring

Because knotweed is such a major threat and such a large amount of effort has been put into eradicating it, all known sites of knotweed will continue to be monitored annually. Any knotweed found will be immediately treated.

A key tenant of the Major Watersheds Invasive Species Program is the Early Detection/Rapid Response (EDRR) protocol. This strategy involves routine surveys for invasive species, including surveying for species already present as well as species that potentially could invade but have not yet been documented. If a new infestation is found, it is rapidly treated while it is still small enough to eradicate in a cost-effective manner and before it has a chance to spread and cause ecological damage. This strategy has been proven world-wide to be the most cost-effective way to deal with invasive species.

As part of the EDRR strategy, in 2008 we conducted an aquatic survey for Eurasian milfoil (*Myriophyllum spicatum*) in areas of the wetland that could support this plant. No milfoil was found. Also as part of EDRR, the wetland has been divided into seven sections, with each section surveyed on a frequency ranging from one to five years depending on the level of risk of invasion. For example, areas with existing treated infestations of multiple species are surveyed annually, while areas where no invasive species have been found are surveyed every five years.

Amphibian egg mass surveys are conducted annually in areas of the wetland that provide suitable breeding habitat. Two species (red-legged frogs and northwestern salamanders) are sufficiently abundant to be tracked. For more information see [http://www.seattle.gov/util/About\\_SPU/Water\\_System/Habitat\\_Conservation\\_Plan/Species/Amphibians/Pond-Breeding/StatusintheCedar/index.htm](http://www.seattle.gov/util/About_SPU/Water_System/Habitat_Conservation_Plan/Species/Amphibians/Pond-Breeding/StatusintheCedar/index.htm). This information, along with the invasive plant survey data, provide staff with a system to detect negative changes within the wetland that we can then respond to with appropriate management actions.

## Appendix I

### Details of restoration work conducted in the Rock Creek Wetland

Year	Focus	Restoration Work	Notes	Staff Person Days	Contractor Person Days	Contractor Cost	Volunteer Person Days
2002	Decommission	16 Road Decommissioned	SPU Operations crew				
	Planting	Plant native species along decommissioned road	1,612 trees, 72 shrubs	1			22
2003	Knotweed	Pull knotweed	1 volunteer event in June	1			10
2004	Knotweed	Install fabric	Install 25,000 ft <sup>2</sup> of fabric over patches along decommissioned 16 road (3 types of fabric - black plastic and 2 geotextile)	5	5	\$1,200	6
	Knotweed	Maintain fabric/pull plants	Stomp all growth under fabric, repair fabric, pull all knotweed plants	5			
2005	Knotweed	Maintain fabric/pull plants	Repair fabric, stomp all growth under fabric, pull all knotweed plants. Replace torn black plastic with geotextile & haul out old plastic	8			
	Blackberry	Grub out patches	Along decommissioned road		3	\$600	
2006	Knotweed	Install fabric	Cover newly found large patches within wetland with 4,850 ft <sup>2</sup> fabric	2	13.5	\$2,700	
	Knotweed	Maintain fabric/pull plants	Repair fabric, stomp all growth under fabric, pull all knotweed plants. Replace torn black plastic with geotextile & haul out old plastic	7	6	\$1,200	
	Blackberry	Grub out patches	Along decommissioned road and within wetland down channel #2,	3	12	\$2,400	
	Thinning	Thin alder	Thin around planted conifers		1.5	\$1,800	
2007	Planting	Plant native species along decommissioned road and within wetland around covered knotweed patches	470 trees, 192 shrubs	3	5	\$1,000	19



	Knotweed	Survey	Walk transects through wetland surveying for knotweed with King County Noxious Weeds and SPU staff	5			4
	Knotweed	Install fabric	Cover 3 newly found patches within wetland with 680 ft <sup>2</sup> of fabric	1	1	\$200	
	Knotweed	Maintain fabric/pull plants	Repair fabric, pull all knotweed plants. Replace torn plastic with geotextile & haul out old plastic.	6	10	\$2,000	
	Blackberry	Survey	Staff survey along Rock Creek and within wetland; map all blackberry found	2			
2008	Knotweed	Maintain fabric/pull plants	Repair fabric, pull all knotweed plants. Replace torn plastic with geotextile & haul out old plastic.	9	10	\$2,000	
	Knotweed	Remove fabric	Remove 400 ft <sup>2</sup> fabric from small patches placed in 2004, now inundated	0.5	5	\$1,000	
	Knotweed	Install fabric	Cover newly found patch within wetland with 200 ft <sup>2</sup> fabric	0.1			
	All Invasives	Survey	Staff conduct walking survey within wetland; map locations of all invasives.	6			
	All legally required Invasive Species	Survey	Expert botanists conducted walking survey in northwest and south portions of the wetland for all species legally required plus Canada and bull thistle		4	\$1,280	
	Milfoil	Survey	Contractor conduct aquatic survey for milfoil - none found.		1	\$3,700	
	Butterfly Bush	Grub out	One plant found and grubbed out	0.1			
	Blackberry	Grub out patches	Within wetland		51	\$10,200	
2009	Knotweed	Maintain fabric/pull plants	Repair fabric, pull all knotweed plants.	7.5	9	\$2,800	

	Knotweed	Remove fabric	Remove ~4,400 ft <sup>2</sup> of fabric from small areas installed in 2004 and now very wet. Haul out old fabric	1	10	\$3,900	
	All Invasives	Survey	Survey within wetland; map locations of all invasives	2			
	Blackberry	Grub out patches	Within wetland		9	\$2,800	
	Nightshade	Grub out/remove dense patches	Within wetland		9	\$2,800	
2010	Knotweed	Maintain fabric/pull plants	Repair fabric, pull all knotweed plants.	4			
	Knotweed	Remove fabric	Remove ~5,500 ft <sup>2</sup> of fabric installed in 2004 along decommissioned road.	1.5	10	\$2,075	
	All Invasives	Survey	Survey within wetland; map locations of all invasives	2.5			
	Nightshade	Grub out/remove dense patches	Within wetland		15	\$4,680	
	Butterfly Bush	Grub out	Two plants found and grubbed out	0.2			
	Blackberry	Grub out	Within wetland		27	\$8,424	
2011	Knotweed	Remove fabric	Remove ~14,700 ft <sup>2</sup> of fabric installed in 2004 along decommissioned road and haul out most of old fabric.	3.5	8.5	\$1,240	
	Knotweed	Herbicide treatment	Treat 685 small isolated stems with backpack spray	0.5		\$75	
	Planting	Plant native species along decommissioned road where fabric had been removed	89 trees	0.5	0.5	\$75	
	Blackberry	Grub out	Along decommissioned road		2		
2012	Knotweed	Remove fabric	Remove 5,530 ft <sup>2</sup> of fabric installed in 2006 & 2007 on large patches within wetland	1	4	\$580	
<b>Grand Totals</b>				<b>88.9</b>	<b>232</b>	<b>\$60,729</b>	<b>61</b>